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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/845,985	04/30/2001	Benjamin Chaloner-Gill	2950.20US01	2942

62274 7590 12/22/2008
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EXAMINER	
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ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
12/22/2008	PAPER

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte BENJAMIN CHALONER-GILL,
ALLISON A. PINOLI, CRAIG R. HORNE,
RONALD J. MOSSO, and XIANGXIN BI

Appeal 2008-4615
Application 09/845,985
Technology Center 1700

Decided: December 19, 2008

Before CHARLES F. WARREN, CATHERINE Q. TIMM, and
MICHAEL P. COLAIANNI, *Administrative Patent Judges*.

COLAIANNI, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 the final rejection of claims 1-3, 6-9, 12, 14-21, 48-50, 52-56, and 58-61.[1] We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).

We AFFIRM-IN-PART.

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[1] A hearing was held in the appeal on November 18, 2008.

INTRODUCTION

Appellants claim a collection of particles comprising a composition with a phosphate anion and a lithium cation, the collection of particles having specific average particles sizes and specific particle size distributions (e.g., claims 1, 21, 55, and 58). Appellants disclose that the collection of particles may be used to form electrodes in batteries (Spec. 1).

Claims 1, 2, 15, 21, 55, and 58 are illustrative:

> 1. A collection of particles comprising a crystalline composition with a phosphate anion and a lithium cation, the collection of particles having an average particle size less than about 1000 nm and having essentially no particle with a diameter greater than about 5 times the average particle size.
>
> 2. The collection of particles of claim 1 having an average particle size from 5 nm to about 250 nm.
>
> 15. The collection of particles of claim 1 having a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.
>
> 21. A collection of particles comprising a collection of amorphous particles, the particles comprising a phosphate composition having an average particle size less than about 95 nm and having essentially no particle with a diameter greater than about 5 times the average particle size.
>
> 55. A collection of particles comprising a crystalline composition with a phosphate anion and a lithium cation, the collection of particles having an average particle size less than about 1000 nm and having a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

58. A collection of particles comprising a collection of amorphous particles, the particles comprising a phosphate composition having an average particle size less than about 95 nm and having a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

The Examiner relies on the following prior art references as evidence of unpatentability:

Kamauchi	5,538,814	Jul. 23, 1996
Manev	5,789,115	Aug. 4, 1998
Bödiger	5,849,827	Dec. 15, 1998
Goodenough	5,910,382	Jun. 8, 1999
Bi	5,952,125	Sep. 14, 1999

Appellants appeal the following rejections:

1. Claims 1-3, 6-9, 12, 14-21, 48-50, 52-56, and 58-61 are rejected under 35 U.S.C. § 112, second paragraph, as failing to particularly point out and distinctly claim the subject matter which applicants consider to be the invention.[2]
2. Claims 1-3, 6, 7, 12, 14-17, 19-21, 48-50, 52, 53, 55, 56, and 58-61 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kamauchi in view of Manev.

[2] Appellants indicate that claims 10, 13, and 51 are rejected under 35 U.S.C. § 112, second paragraph (App. Br. 6). The Examiner also maintains that claims 13 and 51, but not claim 10, are rejected under 35 U.S.C. § 112, second paragraph (Ans. 3). However, claims 10, 13, and 51 were canceled (App. Br. 3) and, thus are no longer pending. Accordingly, claims 10, 13, and 51 are not on appeal.

3. Claims 8, 9, and 18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kamauchi in view of Manev and Goodenough.
4. Claims 54, 58, 59, and 61 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bödiger in view of Bi.

With regard to the first rejection, Appellants do not argue any claim in particular. Rather the claims are argued as a group (App. Br. 9-10). Accordingly, we select claims 1 and 53 as representative claims on which to address Appellants' arguments regarding the rejection. 37 C.F.R. § 41.37(c)(1)(vii)(2004).

With regard to the second and third rejections, Appellants argue claims 1, 6-9, 14, and 16-20 as Group I; claims 2 and 3 as Group II; claim 15 as Group III; claims 12, 21, 48-50, and 52-54 as Group IV; claims 55 and 56 as Group V; and claims 58-61 as Group VI (App. Br. 7-8). Pursuant to 37 C.F.R. § 41.37(c)(1)(vii), we select claim 1 a representative of Group I; claim 2 as representative of Group II; claim 15 as representative of Group III; claim 21 as representative of Group IV; claim 55 as representative of Group V; and claim 58 as representative of Group VI. The non-representative claims of the respective groupings stand or fall with the representative claim. 37 C.F.R. § 41.37(c)(1)(vii)(2004).

With regard to the fourth rejection, Appellants argue the claims as a group (App. Br. 28-31). We select claim 58 as the representative claim on which to render our decision. 37 C.F.R. § 41.37(c)(1)(vii)(2004).

35 U.S.C. § 112, SECOND PARAGRAPH REJECTION:
CLAIMS 1 AND 53

STATEMENT OF THE CASE

The Examiner determines that the phrase "greater than about", "at least about" and "less than about" fail to particularly point out and distinctly claim the subject matter which Appellants regard as their invention (Ans. 3). The Examiner argues that because the phrases "greater than" and "at least" describe definite minimums and "less than" describes a definite maximum, the word "about" contradicts those maximum and minimum values (Ans. 3).

Appellants argue that the Examiner has not established a prima facie case of indefiniteness (App. Br. 16). Appellants contend that the term "about" is interpreted in a claim based on the particular facts of the case and its use reflects the natural imprecision in expressing continuous variables with approximate cut off values at a particular precision (App. Br. 17). Appellants argue that one of ordinary skill in the art would understand the meaning of "greater than about", "at least about" and "less than about" in the claims (App. Br. 16-18).

ISSUE

Did Appellants show that the Examiner reversibly erred in determining that "less than about" and "greater than about" in claim 1 and "at least about" in claim 53 render the claims indefinite under 35 U.S.C. § 112, second paragraph? We answer that question in the affirmative.

PRINCIPLES OF LAW

The test for definiteness under 35 U.S.C. § 112, second paragraph, is whether "those skilled in the art would understand what is claimed when the

claim is read in light of the specification." *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1576 (Fed. Cir. 1986).

The meaning of the word "about" is dependent on the facts of a case, the nature of the invention, and the knowledge imparted by the totality of the earlier disclosure to those skilled in the art. *Eiselstein v. Frank*, 52 F.3d 1035, 1040 (Fed. Cir. 1995).

FACTUAL FINDINGS (FF)

1. The Specification describes that the particle properties include:

   > A collection of particles of interest *generally* has an average diameter for the primary particles of less than about 1000 nm, in most embodiments less than about 500 nm, in other embodiments from about 2 nm to about 100 nm . . . . (emphasis added) (Spec. 35-36).

2. The Specification further describes that "A person of ordinary skill in the art will recognize that average diameter ranges within these specific ranges are also contemplated and are within the present disclosure." (Spec. 36).
3. The Specification explains that particle diameters are generally evaluated by transmission electron microscopy and diameters of asymmetrical particles are based on an average of length measurements along the principle axes of the particle (Spec. 36).
4. The Specification describes that the particles "preferably have a high degree of uniformity in size"; "a very narrow range of particle diameters" (Spec. 37).
5. In describing the narrow ranges of particles diameters, the Specification states that "the primary particles generally have a distribution in sizes such that at least about 95 percent, and preferably about 99 percent, of the primary particles have a diameter greater than

about 40 percent of the average diameter and less than about 225 percent of the average diameter." (Spec. 37).

ANALYSIS

Based on findings above (FF 1-5), we determine that an ordinarily skilled artisan would understand the meaning of "greater than about", "at least about" and "less than about" when read in light of the Specification. Specifically, the Specification indicates that transmission electron microscopy is used to determine the particles sizes and their distribution based on average length measurements (i.e., there is some variation within the measurements of individual particle sizes) (FF 3-5). The Specification describes that "at least about" a certain amount of particles have particles sizes generally "less than about" or "greater than about" a particle size (FF 1-5). Accordingly, one of ordinary skill in the art would understand from the Specification that "about" as used in the phrases "greater than about" or "less than about" permits reasonable variations in particle size around the end point. *Eiselstein*, 52 F.3d at 1040. Moreover, one of ordinary skill in the art would understand from the Specification that "about" in the phrase "at least about" permits reasonable variations in the amount of the particles having a specific average particle size. Accordingly, we cannot sustain the Examiner's § 112, second paragraph, rejection of claims 1-3, 6-9, 12, 14-21, 48-50, 52-56, and 58-61 as failing to particularly point out and distinctly claim the subject matter which the applicant considers to be the invention.

35 U.S.C § 103 REJECTIONS OVER KAMAUCHI IN VIEW OF MANEV AND KAMAUCHI IN VIEW OF MANEV AND GOODENOUGH

CLAIMS 1, 2, 15, 21, 55, AND 58

STATEMENT OF THE CASE

The Examiner finds that Kamauchi discloses all the features of claims 1, 2, 15, 21, 55, and 58, except for the particular claimed particle size distributions (Ans. 4-5). The Examiner finds that Manev discloses that the particle size and particle size distribution are two of the basic properties characterizing the positive electrode intercalation materials for lithium secondary batteries (Ans. 5). Specifically, the Examiner finds that a decrease in the mean particle size and mean particle size distribution results in an increase in the ability to cycle the electrode active materials (Ans. 5). Based on these findings, the Examiner concludes that it would have been obvious "to prepare an electrode comprising a collection of electrode material particles as taught in Kamauchi having a greater number of particles as close in size to the desired average diameter as possible, as a uniform, average diameter has been shown to be critical to the invention (Kamauchi col. 5, lines 25-end; Manev col. 1, lines 34-50.)" (Ans. 5).

Appellants argue that Kamauchi and Manev fail to teach a submicron powder with particles having the claimed uniformity (App. Br. 20, 25-27). Appellants further argue that there is no reasonable expectation that Manev's teaching to decrease particle size and particle size distribution, which is directed lithium metal oxides, would have been successful with metal phosphate compositions as claimed (App. Br. 20). Appellants further allege that the § 132 Declaration submitted by Craig Horne and On Chang (hereinafter the Horne Declaration) evinces that the combination of Kamauchi in view of Manev would not reasonably be expected to produce the claimed particle size and particle size distribution (App. Br. 23-24).

Appellants further argue that Manev's teaching that the particles must not be made too small teaches away from tailoring the particles to the claimed particles sizes and distributions (App. Br. 20-21, 23).

Appellants further contend that even if a prima facie case of obviousness has been established by the Examiner, the Horne Declaration rebuts the prima facie case (App. Br. 23).

ISSUES

1. Have Appellants shown that the Examiner reversibly erred in determining that Kamauchi in view of Manev teach or suggest the claimed particle size and particle size distribution? We answer this question in the negative.
2. Have Appellants shown that the Examiner reversibly erred in determining that there is a reasonable expectation of success in combining Manev's disclosure to decrease particle size and particle size distribution for positive electrode (i.e., cation) intercalation materials with Kamauchi's cationic electrode in a lithium battery? We answer this question in the negative.
3. Have Appellants shown that the Examiner reversibly erred in determining that Manev does not teach away from the combination of a decreased particle size and particle size distribution for positive electrode (i.e., cation) intercalation materials with Kamauchi's cationic electrode in a lithium battery? We answer this question in the negative.

4. Did the Appellants' evidence provided in the Horne Declaration rebut the Examiner's obviousness rejection? We answer this question in the negative.

PRINCIPLES OF LAW

For a prima facie case of obviousness all the claim features must be taught or suggested by the applied prior art. *In re Royka*, 490 F.2d 981, 985 (CCPA 1974). The test for obviousness is what the combined teachings of the prior art would have suggested to one of ordinary skill in the art. *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). A prima facie case of obviousness may be made when the only difference from the prior art is a difference in the range or value of a particular variable. *In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003); *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990). Where the difference between the prior art and a claimed invention is some range or variable with in the claims, the applicant must show that that particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range. *Woodruff*, 919 F.2d at 1578.

Obviousness does not require an absolute predictability of success, all that is required under § 103 is a reasonable expectation of success. *In re O'Farrell*, 853 F.2d 894, 903-04 (Fed. Cir. 1988). The presence or absence of a "reasonable expectation of success" is a pure question of fact. *Alza Corp. v. Mylan Laboratories, Inc.*, 464 F.3d 1286, 1289 (Fed. Cir. 2006).

A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from

the path that was taken by the applicant. *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994). The degree of teaching away will of course depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant. *Id.*

Objective evidence of non-obviousness must be considered when presented. *Stratoflex Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983). Applicants have the burden of explaining data in any declaration proffered as evidence of non-obviousness, and mere reference to such declarations does not adequately discuss declarant's teachings. *Ex parte Ishizaka*, 24 USPQ2d 1621, 1624 (BPAI 1992).

FACTUAL FINDINGS (FF)

1. Kamauchi discloses a positive electrode active material favorably used in a lithium secondary battery, which has high energy density leading to high discharge capacity, high electromotive force, high discharge voltage, and excellent cycle properties (col. 1, ll. 9-15).
2. Kamauchi discloses that the properties desired in lithium secondary batteries include high energy density and long cycle life (i.e., the ability to withstand repetitive charge and discharge cycles) (col. 1, ll. 19-23).
3. Kamauchi discloses the positive electrode active material may be made of lithium, phosphorous, and a transition metal such as cobalt and/or iron (col. 3, ll. 31-38; col. 4, ll. 44-51).
4. Kamauchi discloses pulverizing the positive electrode active material into particles having desirable sizes as necessary (col. 3, ll. 55-56).

5. Kamauchi discloses that pulverizing maybe conducted in a ball mill and that the average particle size is a function of the pulverizing time in the ball mill (col. 19, ll. 59-63).
6. Kamauchi discloses in Example 12 that the active material average particle size maybe 0.01 μm (i.e., 10 nm) (col. 20, l. 10).
7. Kamauchi discloses that the average particle size range may be from 0.01-20 μm (i.e., 10-2000 nm) (claim 3).
8. Manev discloses spinel $Li_{1+X}Mn_{2-X}O_{4+Y}$ intercalation compounds that may be used for positive electrodes in secondary lithium cells (col. 1, ll. 10-13, 29-31).
9. Manev discloses in the "Background of the Invention" section that it is generally known that "[t]he mean particle size and the particle size distribution are two of the basic properties characterizing the positive electrode intercalation materials for secondary lithium batteries" (col. 1, ll. 34-37).
10. Manev further discloses that generally the mean particle size and particle size distribution are considered important because they "directly influence the charge-discharge rate capability, the safety cell performance, the electrode formulation and the electrode coating process of positive electrodes containing these materials (col. 1, ll. 37-41).
11. Manev discloses that "a decrease in the mean particles size and distribution of the intercalation compounds typically results in an increase in the cycleability of these compounds" (col. 1, ll. 41-44).
12. Manev discloses that the smaller particles increase the cycleability of the battery because the smaller particles are more flexible than larger

particles such that the changes in the crystal lattice that result during cycling do not damage the cycleablity of the smaller particles (col. 1, ll. 44-49).

13. We find that Manev's disclosures in Factual Findings 9 to 12 are directed to intercalation materials generally, and are not limited to Manev's spinel intercalation material.
14. With regard to the spinel intercalation material, Manev discloses that it is not desirable to grind the material to decrease the particle size and particle size distribution because such mechanical treatment changes the structure of the spinel and thereby lowers the specific capacity of the material (col. 2, ll. 5-20).
15. Manev discloses that the spinel materials preferably have a particle size of 1 to 15 microns and particle size distribution of wherein at least about 99% of the particles have a diameter of less than 40 microns (col. 2, ll.41-47; col. 4, ll. 64-67), which touches the claimed "less than about 1000 nm" (i.e., less than about 1 μm) range of claim 1.
16. Appellants state the Horne Declaration provides experimental results that "confirm Applicants assertions that the grinding approaches described in the Kamauchi patent do not produce particles with the uniformity of the particle collections covered under Applicants' pending claims" (i.e., no reasonable expectation of success) (App. Br. 23-24).
17. Appellants do not explain how the Horne Declaration evidence shows that the particle size and particle size distribution is not achieved by using Kamauchi's grinding process.

18. Appellants have not explained and it is unclear from the "attached report"[3] referred to in paragraph 7 of the Horne Declaration what are the average particle sizes of the ground samples.
19. Appellants state that the Streibel article[4] shows that phosphates are known to have increased inherent stability during cycling such that the desirable properties of phosphate submicron particles were unexpected in the application of secondary batteries (i.e., unexpected results) (App. Br. 20).
20. The Streibel article concludes that a carbon coating on the phosphate particles is critical to improve the electrical conductivity of the $LiFePO_4$ particles and that the particle size and particle size distribution should be small and narrow, respectively (Streibel A669).
21. Appellants also refer to the Delacourt[5] article as showing "electrode[s] with uniform submicron particle sizes have improved rate performance in a battery" (App. Br. 24).
22. The Delacourt article concludes that a soft chemistry method allowed the preparation of C-free $LiFePO_4$ particles in the 100-200 nm range with a very narrow size distribution, and these particles exhibit very satisfactory electrochemical properties in terms of specific capacity and capacity retention upon cycling (Delacourt A354).

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[3] We understand the "attached report" to be the 14 page document titled "Grinding of Lithium Cobalt Phosphate Mixed Phase Material (Li-Co-PO4) and Lithium Iron Phosphate (LiFePO4)" authored by On Chang and Craig Horne for Nanogram Corporation.
[4] Streibel, Kathryn et al., *Comparison of LiFePO4 from Different Sources*, J. of The Electrochemical Society, 152(4) A664-A670 (2005).
[5] Delacourt, C. et al., *Size Effects on Carbon-Free LiFePO4 Powders*, Electrochemical and Solid-State Letters 9 (7) A352-A355 (2006).

ANALYSIS

Issue 1: Claimed Particle Size and Distribution

Kamauchi discloses a positive electrode material made of lithium phosphorous and iron, which is pulverized into particles of desirable sizes (FF 3 and 4). Kamauchi discloses that the electrode material may be pulverized to an average particle size of 0.01 μm (i.e., 10 nm) (FF 6 and 7). Kamauchi discloses that a desired property in lithium secondary batteries includes long cycle life (FF 2).

Manev discloses spinel (i.e., $Li_{1+X}Mn_{2-X}O_{4+Y}$) intercalation material for positive electrodes in secondary lithium cells (FF 8). However, Manev teaches in the "Background of the Invention" section that it is generally known that a decrease in mean particle size and particle size distribution of intercalation material, not only spinel intercalation material, is desirable to increase the ability to cycle the battery (FF 9-13).

Based on these findings, we agree with the Examiner that Kamauchi's and Manev's teachings as a whole would have suggested decreasing the particle size to a submicron particle size as taught by Kamauchi (FF 7) and decreasing the particle size distribution to include those recited in Appellants' claims 1, 15, 21, 55, and 58 to increase the ability to cycle the battery. *Keller*, 642 F.2d at 425.

Moreover, the disclosures of Manev and Kamauchi regarding intercalation materials differ from the claimed invention only in terms of their particle size distribution ranges. As such, Appellants must show that the particle size distribution ranges recited in claims 1, 15, 55, and 58 are critical (i.e., unexpected results). *Woodruff*, 919 F.2d at 1578.

However, Appellants have not provided any persuasive evidence that the recited particle size distribution ranges are critical to the invention (i.e., unexpected results were achieved). The only evidence proffered that allegedly shows the criticality of the particle size and its distribution are the Streibel and Delacourt articles (FF 19 and 21).

The Streibel article relied on by Appellants to show that the desirable properties of phosphate submicron particles were unexpected in the application of secondary batteries (i.e., unexpected results), merely shows that providing a carbon coating on $LiFePO_4$ particles improves the electronic conductivity of the material (FF 19 and 20). Moreover, regarding the particle size and distribution, Streibel merely states that the particle size should be small and have a narrow distribution to permit good utilization of the $LiFePO_4$ material (FF 20).

The Delacourt article concludes that $LiFePO_4$ material having particles sized within the range of 100-200 nm and a narrow size distribution exhibit very satisfactory electrochemical properties (i.e., specific capacity and capacity retention upon cycling) (FF 22).

However, the allegedly unexpected results achieved by having a submicron particle size and narrow particle size distribution, which the Streibel and Delacourt documents are said to teach, are what the combination of Kamauchi in view of Manev teaches (FF 1-13). Specifically, Kamauchi discloses that the average particle size for positive electrode active materials may be 10 nm (i.e. submicron) (FF 6). Manev discloses the importance of having a narrow particle size distribution and small particle size (i.e., that includes 1 μm) to improve the cycling function of the battery (FF 9-13). Thus, the teachings of the references demonstrate that it is known

in the positive electrode material art to use submicron particle sizes and have a narrow particle size distribution in order to achieve desirable electrochemical properties, such as cycling of the battery. In other words, Appellants' "unexpected results" for phosphate materials are merely what an ordinarily skilled artisan would have expected.

With regard to claims 2 and 21, we further find that Kamauchi's disclosure of an average particle size of 10 nm (FF 6) satisfies Appellants' claims features of "an average particle size from 5 nm to about 250 nm" and "less than about 95 nm" in claims 2 and 21, respectively.

Issue 2: Reasonable Expectation of Success

Appellants argue that Manev's disclosure is limited only to lithium metal oxides and not metal phosphate compositions such that it is unclear if Manev's disclosure that smaller particles increase cyclability of the battery because the smaller particles are more flexible would apply to metal phosphate compositions (App. Br. 20). However, we understand Manev's disclosure regarding the particle size and particle size distribution as relating to intercalation materials generally, and not Manev's spinel intercalation material specifically (FF 13). Our understanding is supported by Manev's disclosure beginning around column 1, line 17, that precedes the paragraph discussing the particle size and particle size distribution. At column 1, line 17, Manev states "[h]eretofore, lithium intercalation compounds *such as* $Li_{1+X}Mn_{2-X}O_{4+Y}$ [i.e., spinel] have be used in positive electrodes for 4 V secondary lithium and lithium ion batteries" (Manev, col. 1, ll. 17-19). Manev's disclosure indicates that the spinel material in the context of the "Background of the Invention" is simply exemplary.

Moreover, Manev discloses that "mean particle size and the particle size distribution are two of the basic properties characterizing the positive electrode intercalation materials for secondary lithium batteries" indicates the disclosure relates to intercalation materials generally, not solely spinel. (Manev, col. 1, ll. 34-37).

Accordingly, we do not find that Manev's disclosure in the Background of the Invention regarding particle size and particle size distribution is restricted solely to spinel (i.e., lithium metal oxides). Rather, we find that Manev's disclosure regarding particle size and particle size distribution relates to positive electrode intercalation materials generally and would have provided a reasonable expectation that decreasing particle size and narrowing the particle size distribution would beneficially affect the properties (e.g., cyclability) of the battery.

Appellants further argue that the Horne Declaration provides evidence that there is no reasonable expectation that Kamauchi would be able to produce the particle size and particle size distribution (App. Br. 23-25). However, Appellants have not explained the data in the Horne Declaration or its "attached report" proffered as evidence of non-obviousness, and mere reference to the Horne Declaration does not adequately discuss declarant's teachings (FF 16 and 17).[6] Notably, neither the Horne Declaration nor the

[6] At the hearing, Appellants' counsel indicated that the average particle size was disclosed on page 14 of the "attached report" to the Horne Declaration (Hearing Transcript 5-6). However, in our review of page 14 of the "attached report" we do not find any explicit statement of average particle sizes for the various tests disclosed by Appellants in the "attached report." Moreover, Appellants have not explained how the average particle sizes may be determined from the data provided, if that is even possible. Appellants

attached report clearly indicates what "average particle size" was achieved by grinding (FF 17). Without such information, it is impossible to determine whether the evidence shows that the claimed particle size distribution was not achieved because the claims recite the distribution in relation to the average particle size.

For the above reasons, we find Appellants' evidence fails to establish that there is no reasonable expectation of success in using Kamauchi's grinding process to achieve the claimed particle size and particle size distribution. Rather, we find that the teachings of Kamauchi and Manev as a whole would have provided a reasonable expectation that using a smaller particle size and a narrow particle size distribution would successfully improve the properties of the batteries.

Issue 3: Teaching Away

Appellants contend that Manev's disclosure that the particles should not be made too small and that the size is greater than 1 micron teaches away from forming submicron particles (App. Br. 20-21). We do not agree.

Manev's disclosure regarding the particle sizes and distribution all regard the spinel particle size (FF 15). However, Manev has a broader disclosure relating to positive electrode intercalation materials generally, which teaches that the particle size and particle size distribution should be decreased (FF 9-13) that does not discourage one of ordinary skill in the art from seeking smaller particles sizes for intercalation materials generally,

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have the burden of explaining data in any declaration proffered as evidence of non-obviousness. *Ishizaka*, 24 USPQ2d at 1624.

such as taught by Kamauchi. *Gurley*, 27 F.3d at 553. Accordingly, we do not find that Manev teaches away from submicron particle sizes.

To the contrary, we determine that the teachings of the references as a whole would have provided a reason for combining Manev's disclosure to decrease the particle size and particle size distribution with Kamauchi's positive electrode material product. Specifically, Kamauchi's disclosure to form submicron particles coupled with Manev's disclosure regarding the improved cyclability of the battery for smaller particles sizes and narrower particle size distributions would have suggested to an ordinarily skilled artisan making Kamauchi's particles smaller and with a narrower particle size distribution.

For the reasons provided with regard to Issues 1-3, we determine that the Examiner has established a prima facie case of obviousness. Appellants submitted evidence of non-obviousness, which we now consider.

Issue 4: Evidence of Non-obviousness

Appellants contend that the Horne Declaration rebuts any prima facie case of obviousness by showing that Kamauchi's grinding approach to form the claimed material would not work (App. Br. 25). However, we note that Appellants have not explained the data in the Horne Declaration or its "attached report" proffered as evidence of non-obviousness, and mere reference to the Horne Declaration does not adequately discuss declarants' teachings (FF 16 and 17). *Ishizaka*, 24 USPQ2d at 1624. Notably, neither the Horne Declaration nor the attached report clearly indicates what "average particle size" was achieved by grinding (FF 17). Without such information, it is impossible to determine whether the evidence shows that

the particle size distribution was not achieved by using Kamauchi's grinding process because the claims recite the distribution in relation to the average particle size.

For the above reasons, we do not find Appellants' evidence establishes that Kamauchi's method would not achieve the claimed particle size and particle size distribution range. Appellants' evidence does not rebut the Examiner's prima facie case of obviousness.

For the above reasons, we sustain the Examiner's rejection of claims 1-3, 6, 7, 12, 14-17, 19-21, 48-50, 52, 53, 55, 56, and 58-61 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kamauchi in view of Manev, and the rejection of claims 8, 9, and 18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Kamauchi in view of Manev and Goodenough.

35 U.S.C. § 103 REJECTION OVER BÖDIGER IN VIEW OF BI
CLAIM 58

STATEMENT OF THE CASE

The Examiner finds that Bödiger discloses a collection of particles of inorganic powders including aluminum phosphate (Ans. 9). The Examiner further states that aluminum phosphate is a well-known active material in lithium batteries (Ans. 9). The Examiner finds that Bödiger does not disclose the claimed particle size distribution or whether the aluminum phosphate is amorphous or crystalline (Ans. 9-10). The Examiner concludes that it would have been obvious for one of ordinary skill in the art to "prepare the powder either as a crystalline material or as an amorphous material as the material will provide a significant reduction in burning times

in a molding composition regardless of the state of the crystallinity" (Ans. 10).

The Examiner further finds that Bi discloses forming cathode active materials having a high degree of uniformity (Ans. 10). The Examiner concludes that it would have been obvious to optimize the particle size distribution such that the finely divided inorganic powder will "function as the extremely finely divided material in the electrodes taught by Bödiger." (Ans. 11).

Appellants contend that there is "absolutely nothing in the references that would [have] suggest[ed] in any way to combine the references as suggested by the Examiner" (i.e., motivation to combine) (App. Br. 30). Appellants contend that Bödiger is directed to flame retardants and the reference does not suggest how the uniform particles could be obtained or whether the flame retardants would benefit from more uniform particles (App. Br. 30).

ISSUE

Did Appellants show that the Examiner reversibly erred in finding a reason to combine Bi's particle size distribution with Bödiger's inorganic phosphate collection of particles used as flame retardants? We answer this question in the affirmative.

PRINCIPLES OF LAW

A claimed invention "composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR Int'l Co. v. Teleflex Inc.*, 127 S.

Ct. 1727, 1741 (2007). Often it will be necessary "to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed." *Id.* at 1740-41. "A factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant [on] *ex post* reasoning." *Id.* at 1742 (citing *Graham v. John Deere Co.*, 383 U.S. 1, 36 (1966), which warned against a "temptation to read into the prior art the teachings of the invention in issue").

FACTUAL FINDINGS (FF)

23. Bödiger discloses "thermoplastic moulding compositions containing thermoplastic polycarbonates, extremely finely divided inorganic powders and flame retardants" (col. 1, ll. 6-8).
24. Bödiger discloses that the "invention is based on the finding that an addition of extremely finely divided inorganic powders together with flame retardants in thermoplastic polycarbonate molding compositions produces a significant reduction in the burning times and hence a considerable improvement in the flame proofing" (col. 1, ll. 51-56).
25. Bödiger discloses that the inorganic powders may include aluminum phosphates (col. 7, ll. 32-35).
26. Though Bödiger discloses forming moldings of any kind out of the composition, including electrical appliances (e.g., multipoint

connectors) because of its good electrical properties, Bödiger does not disclose forming electrodes from the inorganic powder containing compositions (col. 9, ll. 29-36).

27. It is unclear if Bödiger's "good electrical properties" of the composition are insulative or conductive properties, or whether the electrical properties are attributed to the phosphate material.
28. Bi discloses lithium batteries incorporating nanoparticles, such as vanadium oxide nanoparticles, as an electroactive material (col. 1, ll. 6-9).
29. Bi discloses that the batteries that incorporate nanoparticles such as vanadium oxide nanoparticles lead to lithium batteries with improved performance characteristics (col. 2, ll. 11-13).
30. Bi discloses that vanadium oxide particles have high degree of uniformity in size (col. 8, ll. 27-41).
31. The Examiner's stated motivation for combining Bi's uniform particle size with Bödiger is so that the finely divided inorganic powder will "function as the extremely finely divided material in the electrodes taught by Bödiger" (Ans. 11).
32. With regard to the combination of Bödiger in view of Bi, the Examiner concludes that "it would have been obvious to . . . . prepare [the] cathode of the aluminum phosphate materials taught by Bödiger" with the particle size distributions disclosed by Bi in order to give improved characteristics such as energy density and capacity and because aluminum phosphate is a well known active material in a battery (Ans. 21).

33. The Examiner further determines that "one of ordinary skill in the art would recognize that when a desired average diameter is disclosed in the prior art, choosing particles close to that diameter would be desirable for the function described in the reference" (Ans. 21).
34. Based on the Examiner's determination noted in FF 31, the Examiner concludes that it would have been desirable to form Bödiger's inorganic particles according to Bi's uniform particle size distributions because "[u]sing uniform materials will give a uniform mixture having uniform flame retardation properties" (Ans. 21).

ANALYSIS

Based on the above findings of fact, we determine that there is no reasonable basis for combining Bi's uniform particle size distribution for vanadium oxide cathode active material with Bödiger's thermoplastic molding composition. Specifically, the Examiner's rationale for combining Bi's uniform particle size distribution for vanadium oxide cathode material is erroneously premised on Bödiger's teaching to form electrodes from the finely divided material (FF 30). However, Bödiger does not teach making electrodes from the inorganic powder containing material (FF 26). Rather, Bödiger discloses forming a thermoplastic molding composition having inorganic powder (e.g., aluminum phosphate) and flame retardants that has good electrical properties (FF 23, 24, and 26). However, Bödiger does not teach or suggest using the composition in a cathode or that the disclosed phosphates would be useful in a cathode. In fact, it is unclear if Bödiger's good electrical properties are insulative or conductive, for example, or

whether these electrical properties are attributed to the phosphate material (FF 27).

While, Bi discloses forming cathodes from vanadium oxide having a uniform particle size distribution, there is no apparent reason for one of ordinary skill in the art to form a cathode out of Bödiger's aluminum phosphate, which is part of a thermoplastic molding composition.

The Examiner finds that aluminum phosphate is a well known active battery material (FF 31). Appellants do not dispute that finding. However, it is unclear why one of ordinary skill in the art presented with Bödiger's thermoplastic molding composition containing inorganic powders and flame retardants, would selectively remove the inorganic powder constituent from the thermoplastic molding composition, modify the particle size distribution to have the distribution taught by Bi, and then form a cathode out of the modified inorganic powder (e.g., aluminum phosphate) as apparently proposed by the Examiner's (FF 30 and 31). It appears that the Examiner's combination of Bödiger in view of Bi is based upon impermissible hindsight.

The Examiner further states that it would have been obvious to form Bödiger's inorganic particles according to Bi's uniform particle size distributions because "[u]sing uniform materials will give a uniform mixture having uniform flame retardation properties" (FF 33). However, the Examiner has not provided any evidence that uniform particle sizes produce uniform flame retardation properties. In fact, Bödiger discloses that the combination of the inorganic powder and flame retardants produces a significant reduction in burning time (FF 24). Accordingly, we determine

that the Examiner's rationale based on the uniform particle size as producing uniform flame retardation properties is speculative at best.

For the above reasons, we cannot sustain the Examiner's § 103 rejection of claims 54, 58, 59, and 61 over Bödiger in view of Bi.

DECISION

We reverse the § 112, second paragraph, rejection of claims 1-3, 6-9, 12, 14-21, 48-50, 52-56, and 58-61 as failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

We affirm the § 103 rejection of claims 1-3, 6, 7, 12, 14-17, 19-21, 48-50, 52, 53, 55, 56, and 58-61 over Kamauchi in view of Manev.

We affirm the § 103 rejection of claims 8, 9, and 18 over Kamauchi in view of Manev and Goodenough.

We reverse the § 103 rejection of claims 54, 58, 59, and 61 over Bödiger in view of Bi

The Examiner's decision is affirmed-in-part.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED-IN-PART

PL Initial:
sld

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